MASIMO.7CP1C10 PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Appl. No.	:	10/677,050	Group Art Unit 2154
Applicants	:	Mohamed K. Diab et al.	
Filed	:	September 30, 2003	
TC/A.U.	:	3768	
Examiner	:	Eric F. Winakur	
Title	:	SIGNAL PROCESSING APPARATUS	
Docket No.	:	MASIMO.7CP1C10	
Customer No.	:	20,995	

DECLARATION UNDER 37 C.F.R. § 1.131

Commissioner for Patents
United States Patent and Trademark Office
P.O. Box 1450
Alexandria, VA 22313-1450

Dear Sir:

1. This declaration is to establish the status of the invention in the above-captioned U.S. Patent Application prior to March 26, 1993, the filing date of U.S. Patent No. 5,368,026, issued on November 29, 1994, to Swedlow et al. ("Swedlow").

2. We understand that Claims 1-10, 12-25, 27-36, and 38-46 of the above-captioned U.S. Patent Application Ser. No. 10/677,050 (the '050 Patent Application), which was filed September 30, 2003, titled "*Signal Processing Apparatus*," have been rejected in the May 11, 2007 Office Action as being unpatentable over Swedlow.

3. We are inventors of the subject matter of the above-referenced claims in the '050 Patent Application.

4. At least prior to March 26, 1993, we conceived of a signal processing apparatus such as the device and method described and claimed in the above-referenced claims of the '050 patent application.

5. We provide herewith **Exhibit A** which is a design note ("the Design Note") describing the subject matter of the above-referenced claims. The Design Note was created and is dated prior to March 26, 1993. We conceived the ideas referenced therein prior to the creation of the Design Note. Any references to dates on the Design Note have been redacted.

6. Given the level of detail described in the Design Note, we believe that the actual implementation of the subject matter into software source code would be work of an experienced technician. Thus, we believe that the Design Note reflects an actual reduction to practice prior to the Swedlow filing date.

7. However, if the Examiner concludes that that the Design Note is not sufficient evidence of an actual reduction to practice, but that it evidences, at a minimum, a conception prior to March 26, 1993, the subject matter of the above-referenced claims of the '050 Patent Application was diligently reduced to practice from at least prior to March 26, 1993 through actual reduction to practice.

10. The subject matter disclosed in the Design Note was part of a larger complex system which was implemented in a computer using software ("the Software").

11. Following the documentation of the subject matter disclosed in the Design Note, and further consideration, refinement, and decisions on how to best implement the algorithm in software over the next few months, computer programmers at Masimo Corporation worked to program the Software continuously.

12. At the latest, the subject matter of the Design Note was implemented into the Software no later than October of 1993.

14. As evidence of the continuous work in implementing the subject matter of the Design Note in the Software, we provide herewith **Exhibits B and C** which are lab notebook entries created in May of 1993. These notebook entries reflect information about the algorithm about the time the programmers were implementing the Software. These notebook entries describe the on-going development of the Software and its associated algorithms and reference the subject matter disclosed in the Design Note in connection with this development. Any references to precise dates on the notebook entries have been redacted.

15. We are currently employees of Masimo Corporation and have been employed there from conception of the subject matter of the above-referenced claims through the reduction to practice thereof.

16. Masimo Corporation produces pulse oximetry devices which measure physiological characteristics of pulsing blood by emitting light of multiple wavelengths through body tissue and detecting the attenuated signal with a photo detector.

17. Thus, the subject matter disclosed in the Design Note was for use in pulse oximetry devices.

18. We hereby declare that acts leading to the reduction to practice of the subject matter claimed in the ‘050 Patent Application were performed in the United States.

I declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true, and further that these statements were made with the knowledge that willful, false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful, false statements may jeopardize the validity of the application or any patent resulting therefrom.

Dated: Nov 9th, 2007 By: Mohamed Kheir

Mohamed K. Diab

I declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true, and further that these statements were made with the knowledge that willful, false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful, false statements may jeopardize the validity of the application or any patent resulting therefrom.

Dated: Nov 9, 2007 By: Walter M. Weber

Walter M. Weber

EXHIBIT A

MASIMO™

CORRELATION DETECTION ALGORITHM

Design Notes

Design Note 37	Revision A	File SDN37A.DOC	Project Stork	Page 1 of 2
Author Walter Weber	Revision Date [redacted]	Original Date [redacted]		

The goal of this note is to propose an artifact detector for the Stork algorithm. Specifically, the artifact detector is designed such that it assigns a real number to each snapshot of data that it processes, and then compares that real number to a predetermined threshold value. Snapshots of data which yield artifact detector values that lie below the threshold value are said to contain significant amounts of artifact. Snapshots of data that yield artifact detector values which lie above the threshold value are said to contain insignificant amounts of artifact.

In principle, the Stork algorithm accepts as input two signals which are of the form (after log and bandpass)

$$\begin{aligned} S_a(t) &= s_a(t) + n_a(t) \\ S_b(t) &= s_b(t) + n_b(t) \end{aligned} \qquad (1)$$

where

$$\begin{aligned} s_b(t) &= \omega_1\, s_a(t) \\ n_b(t) &= \omega_2\, n_a(t). \end{aligned} \qquad (2)$$

Any input signals which are not expressable in the above form are said to consist of artifacts. Consequently to determine whether or not a signal is artifact free, it is sufficient to determine whether or not equations (1) and (2) are satisfied.

One way to check whether or not equations (1) and (2) have been met is to measure the correlation between $S_a(t)$ and $S_b(t)$. Specifically one could compute the cross correlation

$$\int S_a(t)\, S_b(t)\, dt = \int (\, s_a(t)\, s_b(t) + n_a(t)\, n_b(t)\,)\, dt + \int (\, s_a(t)\, n_b(t) + s_b(t)\, n_a(t)\,)\, dt$$

which assuming that the signals, $s_a(t)$ and $s_b(t)$, are uncorrelated with the noises, $n_a(t)$ and $n_b(t)$, may be expressed as

$$\int S_a(t)\, S_b(t)\, dt = \int (\, s_a(t)\, s_b(t) + n_a(t)\, n_b(t)\,)\, dt.$$

A normalized cross correlation may be computed as follows

$$\frac{\int S_a(t)\, S_b(t)\, dt}{[\int S^2{}_a(t)\, dt \int S^2{}_b(t)\, dt]^{0.5}} = \frac{\int (\, s_a(t)\, s_b(t) + n_a(t)\, n_b(t)\,)\, dt}{[\int (\, s^2{}_a(t) + n^2{}_a(t)\,)\, dt \;\int (\, s^2{}_b(t) + n^2{}_b(t)\,)\, dt]^{0.5}}.$$

The solutions which give the extrema of this cross correlation functional are given by equation (2). Any input signals which are not expressible in the form given in equation (2) yield reduced normalized correlation values. In Figure 1, these extrema of the normalized correlation functional are plotted vs. the

Copyright © [redacted] MASIMO CORPORATION ™ 26052 Merit Circle Suite 103, Laguna Hills, CA, 92653
This document contains confidential and proprietary information.

"Red" Signal - to - Noise ratio and ω_1/ω_2. One should note that the normalized correlation is not necessarily unity and precaution must be taken, particularly when the difference between arterial saturation and the background saturation is large.

One may rigorously prove that the magnitude of the normalized cross correlation is always less than or equal to unity by use of the inner product

$$x \bullet y = \int x(t)\, y(t)\, dt.$$

Using the above notation, the normalized cross correlation may be written as

$$\frac{s_a \bullet s_b + n_a \bullet n_b}{[(s_a \bullet s_a + n_a \bullet n_a)(s_b \bullet s_b + n_b \bullet n_b)]^{0.5}}$$

or equivalently

$$\frac{S_a \bullet S_b}{[S_a \bullet S_a\ S_b \bullet S_b]^{0.5}}.$$

But, according to the Schwarz Inequality

$$(S_a \bullet S_b)^2 \leq (S_a \bullet S_a)(S_b \bullet S_b).$$

Hence the normalized correlation is always between 1 and -1.

ALGORITHM IMPLEMENTATION

1. Compute the quantity

$$\frac{\Sigma\, S_a S_b}{[\Sigma\, S^2_a\, \Sigma\, S^2_b]^{0.5}}$$

2. Compare quantity to a threshold, say 0.75

THINGS THAT STILL NEED TO BE INVESTIGATED

Investigate performance vs. snapshot size
Investigate performance vs signal/noise correlation

NORMALIZED CROSS CORRELATION
VERSUS ω1/ω2 AND RED SNR

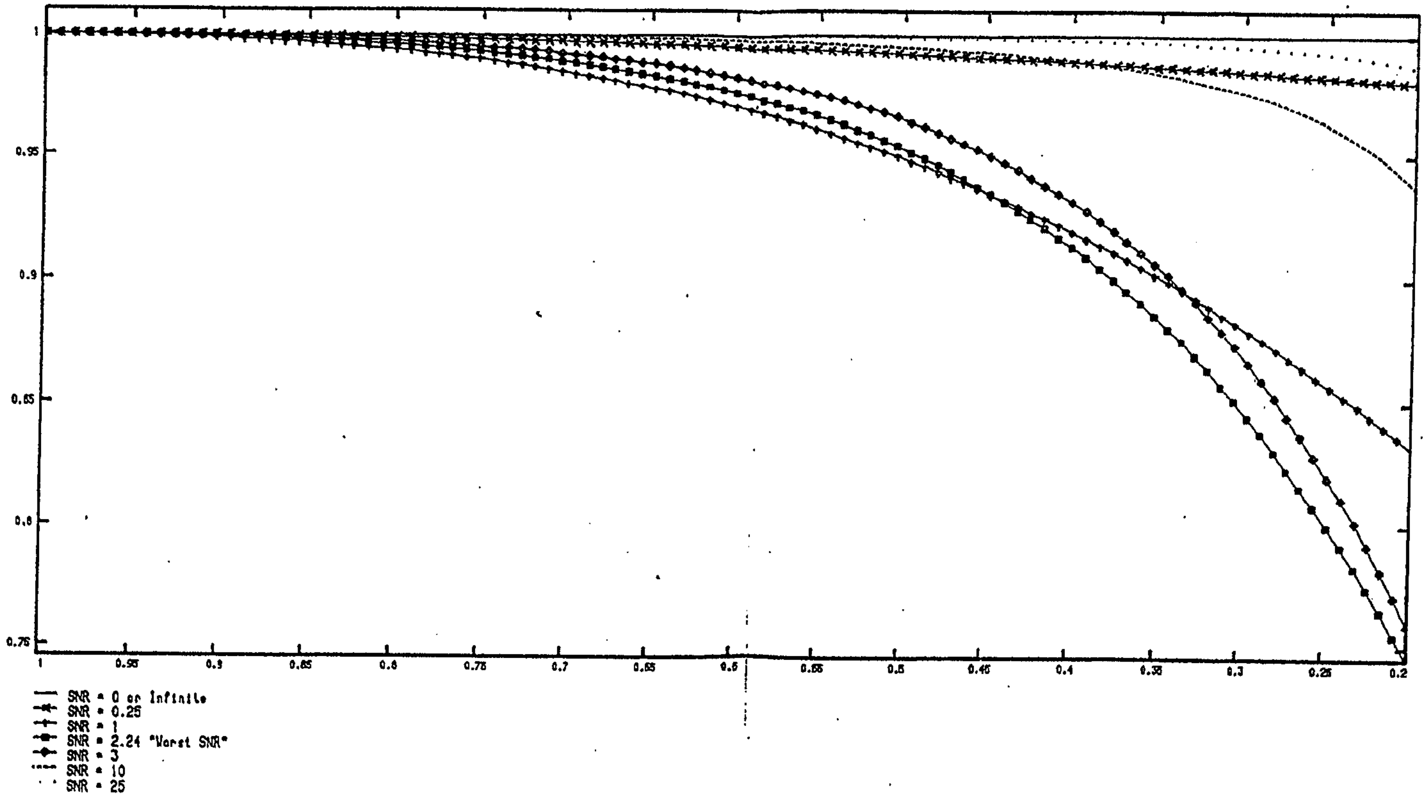
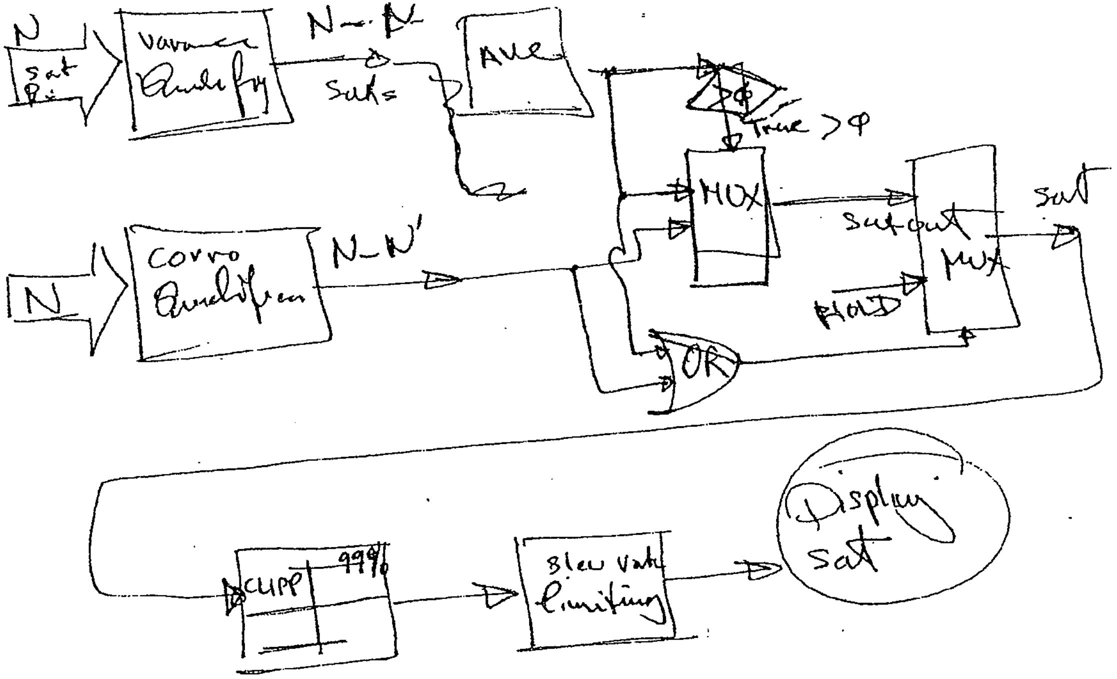


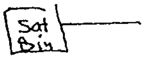
EXHIBIT B

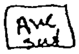
[redacted]



WALT'S ALGORITHM

W2PEAK.C WALT BOX





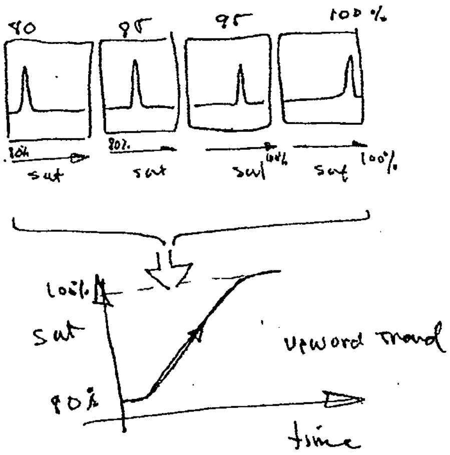
[redacted]

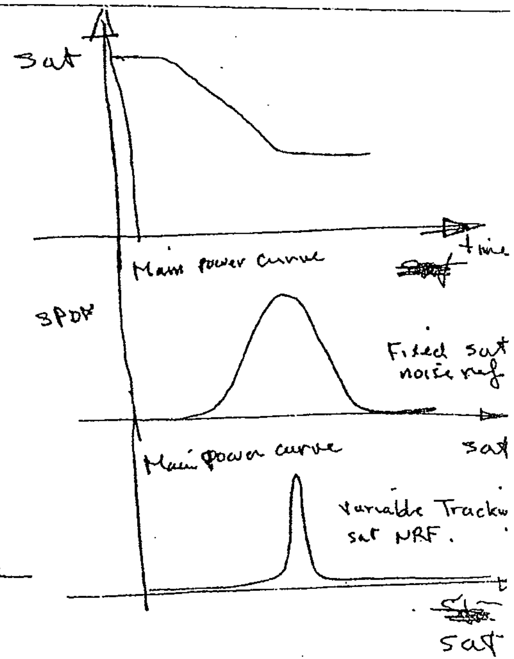
[redacted]

Mohamed Kh

EXHIBIT C

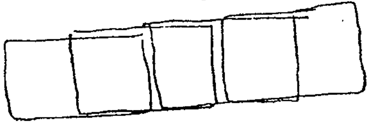
[redacted]





in case of Desat of Resat main Curve looks broad with Fixed sat NRF. However, the situation could be remedied by using Variable Tracking sat NRF.

- overlaping bins



bins with low correlation factor should not be included in the Calculation of The main power Curve.

For Decorrelation try $S+N = S_1+S_2$ it might help.

For noisy ANC OUTPUT try Filtering Low Pass or Band Pass.

variable Lambda i.e. start low initially and ramp up to a plateau. .9 08

Multiply by a sine wave to shift freq.

[redacted]